IL-26-10
1/17/73

INTERNATIONAL
HYDRONICS CORPORATION
Box 910, R-4 PRINCETON, N.J. 08540 PHONE: (201) 329-2361

ENGINEERING REPORT

DEVELOPMENT OF
HYON WASTE MANAGEMENT SERVICES, INC.
CHICAGO PLANT

TO DECEMBER 31, 1972

TO: - State of Illinois
Environmental Protection Agency
- Chicago, Metropolitan Sanitary District
- City of Chicago
Department of Environmental Control

January 17, 1973

By: W. G. Cousins

W. G. Cousins
International Hydronics Corporation

ENGINEERING REPORT

Development of Hyon Waste Management Services, Inc.
Chicago Plant to December 31, 1972

This report describes the development and construction of waste treatment facilities at Hyon Waste Management Services, Inc., as designed and built to December 31, 1972. The report is subdivided into the following sections:

(1) Bio Chemical Treatment Facilities
(2) Chemical Treatment Facilities
(3) Incineration-Evaporation Facilities
(4) Pickle Liquor Treatment Facilities

The following drawings are enclosed and constitute a part of the report:

Drawing No.	Rev.	Title
4-165 L-3	0	Location Map
4-165 PF-2	0	Process Flow Diagram
4-165 L-1	4	General Plot Plan Waste Disposal Facility
4-165 FD-2	1	Flow Diagram Bio Treatment
4-165 M-21	2	Leachate Piping System
4-165 C-9	0	Wastewater Storage Basins & High Solids Basins
4-165 FD-3	0	Flow Diagram Chemical Treatment System
4-165 C-3	0	Chemical Treatment & Piping Arrangement
4-165 FD-1	0	Flow Diagram Incinerator System
4-165 L-5	1	General Plan of Incinerator Area
4-165 FD-4	2	Flow Diagram Incinerator & Evaporative Scrubber
4-165 M-23	2	General Arrangement of Incinerator & Evaporative Scrubber
4-165 FD-7	0	Flow Diagram of Pickle Liquor & Lime Handling System
4-165 C-10	0	Pickle Liquor & Lime Handling System, Layout & Construction of Basins
4-165 M-60	1	Pickle Liquor & Lime Handling System - Piping & Equipment Arrangement Phase I

General

An updated flow plan of the total facility, PF-2, Rev. 0, presented as a box diagram for simplicity, represents the plant as built, under construction and immediately planned. The system concept remains unchanged from original plans, but with modifications and additions indicated and described in the following report sections.

The plant site was expanded by lease of additional area south of the original site as indicated on the Location Map and General Plot Plan.

BIO-CHEMICAL TREATMENT FACILITIES

Drawings: 4-165 FD-2, Rev. 1 Flow Diagram Bio Treatment
4-165 M-21, Rev. 2 Leachate Piping System
4-165 C-9, Rev. 0 Wastewater Storage Basins & High Solids Area

The Bio-Chemical Treatment facilities were constructed as originally designed and that portion of the system remains slightly altered. One change made, as built, was that the outfall pipes from the final basins were not installed.

Alteration of Bio-Chemical Bed Design

A physical change was made in bed design, on the basis of operating experience. The bed underdrains were deepened and bed depths decreased to 1-2 feet. Additionally, ten (10) new bed sumps were added to obtain better bed leachate collection, and as part of the bed heating system.

Bio-Chemical Bed Heating

A heating system for the beds was designed and installed as shown on Drawing M-21, Rev. 2. to provide an additional degree of process control and

to permit winter operations. This system consists of a "hot leachate" recirculation loop under the beds, with heat transfer to the leachate from steam or hot water through heat exchangers. The system also includes new bed sumps and two leachate storage tanks, one of which also serves to equalize flow to the activated sludge unit.

There are two alternate sources of heat, a boiler and the evaporative incinerator.

High Solids Area

An extension of plant capacity in parallel with the Bio-Chemical Beds was made in the form of the High Solids Area (4-165 FD-2, Rev. 1). This area shown on Drawing 4-165 C-9, Rev. 0 is of similar construction to the Bio-Chemical Beds and performs the same functions for waste sludges high in insoluble solids. The purpose of this area is to facilitate handling of sludges which are difficult to pump, which do not require pretreatment, have low levels of soluble organic materials, and which, because of high suspended solids content, would unduly affect bed composition.

Auxiliary Wastewater Basins

Two additional wastewater storage basins were constructed to store accumulated wastewater, and rainfall runoff, pending evaporation in the incinerator scrubbers (Drawing 4-165 C-9, Rev. 0). Auxiliary Basins #1 is of similar construction to the basins originally constructed except that crushed limestone stabilizer was used rather than slag. It is planned to convert this basin to a second High Solids Bed by addition of slag or stone when it is no longer required for wastewater holding.

Auxiliary Basin #2 was constructed like the other basins but without a stone liner. It is planned to partition this basin with clay walls to create two basins for receiving barge shipments, and a diked area for tankage.

Wastewater transfer between the basins has been by means of portable aluminum piping run on the slopes of the basins walls.

CHEMICAL TREATMENT FACILITIES

Drawings: 4-165 FD-3, Rev. 1 Flow Diagram Chemical Treatment System
4-165 C-3, Rev. 0 Chemical Treatment & Piping Arrangement

The design and construction of the Chemical Treatment Facilities was partially completed, as indicated on the flow plant drawing 4-165 C-3. The part of the facility designed consists of a receiving station for unloading trucks by gravity into four underground tanks, a spill collection and operating area, five concrete reaction and holding tanks, an operating pad, and truck docks. The inground concrete and earth work was constructed. The below grade receiving tanks were installed, together with the back pressure tank and associated piping. The facility has not been put in service handling wastewaters but underground tank No. 4 has been used for temporary storage of plant service water.

It is planned to complete the design of the Chemical Treatment Area with the addition of reaction vessels, transfer pumps, and drum handling equipment on the pad area, and construction of a building to house sludge dewatering and other chemical process equipment. Pending completion of this work, the existing tankage may be used to supplement the adjacent Bio-Chemical receiving station, if required.

INCINERATOR FACILITIES

Drawings: 4-165 FD-1, Rev. 0 Flow Diagram Incinerator System
4-165 L-5, Rev. 1 General Plan of Incinerator Area
4-165 FD-4, Rev. 2 Flow Diagram Incinerator & Evaporative Scrubber
4-165 M-23, Rev. 2 General Arrangement of Incinerator & Evaporative Scrubber

The attached drawings are the flow plans and layouts of the incinerator facilities which, together with detailed drawings, constituted applications for approval to State of Illinois EPA Division of Air Pollution Control, the City of Chicago Department of Environmental Control, the Chicago Fire Department. The subsequent correspondence and actions dating from August, 1971 to the present, have resulted in approvals of zoning, construction and operation, but some aspects of operation and stack testing remain to be resolved.

The "Small Incinerator & Evaporative Scrubber" was constructed, and has operated intermittently under a temporary "open burning permit", burning waste oils, and evaporating wastewater from the intermediate basin.

The Large Incinerator, combustion chamber, Kiln and afterburner have been erected, as have the control house, two storage tanks, two blend tanks, and the oil-water separator. A converted hopper bottomed truck was put in temporary service as an oil receiving pretreatment vessel serving the small incinerator. The remainder of the system is under construction.

PICKLE LIQUOR TREATMENT SYSTEM

Drawings: 4-165 FD-7, Rev. 0 Flow Diagram
4-165 C-10, Rev. 0 Layout & Construction of Basins
4-165 M-60, Rev. 1 Piping & Equipment Arrangement Phase I

A small volume of pickle liquor has been used for pretreatment of biochemical wastewaters since the beginning of operations. However, in May 1972,

proposals to treat sulphuric acid pickle liquor from a variety of sources suddenly materialized necessitating the design of two facilities to handle this material, a temporary and a permanent system. Both systems are shown on the above drawings.

The temporary facility was constructed by forming a series of basins below grade between the roadways on the south pier. These basins were lined with lime and used to receive and hold pickle liquor during neutralization. Neutralization was accomplished by adding lime into the basins, finally producing a solid reaction product consisting of calcium sulfate, hydrated iron oxide and excess lime, which was excavated and used as on-site fill.

The method of basin construction, using lime as a liner was unusual and was preceded by some small scale tests. Lime was placed on the bottom and sides of porous boxes and pickle liquor added. It was found that acid penetrated 2-4 inches, was neutralized, and the resulting precipitates of calcium sulfate and iron oxide sealed the surface to liquid passage. It is thought that this occurs because of the property of calcium sulfate to swell on setting and/or the highly hydrated gelatinous nature of the precipitated iron.

The permanent system for treatment of pickle liquors was designed following flow plan 4-165 FD-7. This system was designed in three phases of sophistication. Phase I is a simple lime-acid mixing system.

Phase II is a recirculating system to obtain more efficient use of lime, greater control of sludge characteristics and to provide different sets of reaction conditions.

Phase III includes the addition of other materials into the reaction, these materials being treated and bound into the mixture for disposal, or being additives

to control the character of the sludge product.

The system was designed to produce a solid reaction product in all phases. The product sludge will be allowed to stand in the sludge stabilization area to oxidize the ferrous iron, and to "dry" by evaporation, and sludge hydration. Thereafter, it will be used as on-site fill, or taken to landfill.

A development project was initiated to develop formulations including the sludge which would be useful as construction materials. The use of additive oils and organic binders, for production of compaction-binder materials is a possible product. The use of slag, fly ash, silicates, sulfides, etc. to produce cementing materials is also under investigation. Similar products have been developed and used in Europe and other locations in the United States. The design and provision of Phase III of the Pickle Liquor System is related to and dependent on the outcome of this work.

Construction of the concrete footings for Phases I and II has been completed, and equipment for the Phase I system is on-site but not installed.